REMARKS

Claims 1, 9, 15 and 17-22 are in this application and are presented for consideration. By this Amendment, Applicant has amended claim 9 for a minor informality. It is Applicant's position that the amendment to claim 9 does not raise any new issues and does not change the scope of the claim.

Claims 1, 9, 15 and 17-22 have been rejected under 35 U.S.C. 103(a) as being unpatentable over Choo et al. (U.S. 6,407,360) in view of Okamoto (U.S. 5,502,001) and Xuan (U.S. 6,303,898).

The present invention relates to a scribing device and a method of forming a blind crack, wherein the shape of the blind crack is determined. The scribing device and method comprises a determination unit including a window comparator that determines whether a level of light received after reflecting the light on the blind crack is between predetermined thresholds. This advantageously allows the determination unit to determine the state of the blind crack and to differentiate between a normal blind crack and a defective blind crack when a blind crack has been formed. The determination unit can also determine whether a blind crack has been formed at all. This advantageously allows the determination unit to determine whether the condition of the blind crack is defective or in good condition. This advantageously increases manufacturing and product efficiency of flat panel displays since the brittle substrate materials are broken properly as a result of checking whether the blind crack has been properly formed. The prior art as a whole fails to disclose such features or blind crack shape state determining advantages.

Choo et al. discloses a method of cutting a glass substrate using a laser cutter 206. The laser cutter 206 moves toward the glass substrate 100 such that the rotating blade 264 of the pre-scriber 260, the cutting laser beam 228, and the crack detecting laser beam 237 are aligned with the scriber line 120 defined by the cutting key 20. The rotating axis 262 of the pre-scriber 260 is moved clockwise such that the rotating blade 264 is positioned at the cutting start edge of the scribe line 120 of the substrate 100. The rotating blade 264 rotates at a specific RPM to form a cutting start groove at the start edge of the scriber line 120. After forming the cutting start groove, the rotating blade 264 stops and the rotating axis 262 returns to the original position by moving counterclockwise. The substrate 100 is heated by irradiation of the cutting laser beam 228 of the first laser 220 and is rapidly cooled down by coolant sprayed from the spraying nozzle 244 to generate a crack along the scribe line 120. A crack detecting laser beam 237 is irradiated onto the crack generated, following the coolant sprayed along the scribe line 120. When the crack detecting laser beam 237 is irradiated onto the crack, a part of the crack detecting laser beam 237 is reflected by the crack. A sensor disposed on a wall of a focusing lens housing 296 of the second laser 290 detects an amount of the light reflected from the crack, transforms the detected light amount signal into an electric signal and transfers the electric signal to the microprocessor 400. The microprocessor 400 perceives a propagation path 120' of the crack generated from the input electric signal and compares the propagation path 120' of the crack with the pre-stored path of the marked scribe line 120. By comparison of the two paths, it is determined whether the propagation path 120' of the generated crack deviates from the marked scribe line 120. When the propagation path 120' of the crack corresponds with the

path of the marked scribe line, cutting is continued.

Choo et al. fails to teach and fails to suggest the combination of a polarizing beam splitter and a determination unit including a window comparator. At most, Choo et al. discloses a microprocessor 400 that detects whether the propagation path 120' is on the predetermined scribe line 120. However, the microprocessor 400 does not detect the shape state of a blind crack as featured in the present invention. Compared with Choo et al., the determination unit of the present invention includes a window comparator that extracts the state of the light receiving signal from a light reception element and compares it to predetermined thresholds to determine whether a blind crack is normal or defective or whether a blind crack has been formed at all. This advantageously allows for a simple and quick determination of whether the substrate can be properly broken. In contrast to the present invention, Choo et al. is not concerned with detecting the shape state of a blind crack to determine whether a substrate can be properly cracked. Instead, Choo et al. addresses the problem of making sure that a propagation path 120' of a generated crack follows a predetermined marked scribe line 120. The microprocessor 400 of Choo et al. merely determines whether the propagation path 120' follows the predetermined scribe line 120, but Choo et al. fails to direct the person of ordinary skill in the art toward a determination unit that determines a shape state of a blind crack to determine the condition of a blind crack. As such, the prior art as a whole takes a different approach and fails to direct the person of ordinary skill in the toward a determination unit including a comparator as claimed.

Okamoto also fails to teach or suggest the combination of a determination unit that determines the condition of the shape state of a blind crack. At most, Okamoto discloses a light beam-forming apparatus 10 having a beam expander 11, mirrors 12, 13, 14, half-mirrors 15, 16, lenses 17, 18 and an objective lens 5 that are arranged on an optical path that links a source 1 of light of the optical system to a sample 2. However, Okamoto is completely void of any suggestion or teaching of a determination unit including a comparator that compares a light receiving signal from a light reception element to predetermined thresholds to determine the shape state of a blind crack. Compared to Okamoto, the determination unit of the present invention determines whether a blind crack has been formed and the blind crack is normal or defective. This advantageously increases manufacturing and product efficiency of flat panel displays since the brittle substrate materials are broken properly as a result of checking whether the blind crack has been properly formed. Okamoto fails to disclose such efficiency advantages since Okamoto only directs the person of ordinary skill in the art toward a light beam-forming apparatus, but does not disclose a determination unit including a comparator as featured in the present invention. As such, the prior art as a whole takes a different approach and fails to direct the person of ordinary skill in the art toward each feature of the claimed combination.

Xuan discloses a laser head 200 for delivering laser light beams to opposite surfaces 211 and 212 of substrate 210 mounted on spindle 220 rotated about axis 221 in the direction indicated by arrow A. A laser delivery system comprises an electronic shuttle 230 linked to attenuator 240 and optical coupling 251. Polarizer 280 is connected to beam splitter at one end and optically linked to fiber optic cables 261 and 262 via optical couplings 252. Fiber optic

cable 261 is optically linked to microfocusing lens 292 via optical coupling 253. As substrate 210 rotates, sub-laser light beams 301 and 302 impinge upon surfaces 211 and 212, respectively, forming a uniform pattern of precisely formed protrusions. The system employing fiber optic cables are maintained in position employing clamps 263, 264, 265.

Xuan fails to teach and fails to suggest the combination of a determination unit including a comparator that determines a shape state of a blind crack. At most, Xuan discloses sub-laser light beams 301 that form a pattern on surfaces 211 and 212. However, a determination unit is not provided to determine the condition of a blind crack as featured in the present invention. Xuan merely is concerned with laser texturing a magnetic recording medium, but fails to direct the person of ordinary skill toward addressing the problem of determining the condition of a blind crack. As such, the prior art as a whole takes a different approach and fails to direct the person of ordinary skill in the art toward the claimed combination. Accordingly, Applicant respectfully requests that the Examiner favorably consider claims 1, 9 and 15 and all claims that respectively depend thereon.

Favorable consideration on the merits is requested.

Respectfully submitted
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